

WHAT IS CLAIMED IS:

1. A building material incorporating reinforcing cellulose fibers, wherein at least a portion of the fibers are at least partially treated with a dispersant to form chemically treated fibers with improved dispersibility, wherein the dispersant binds hydroxyl groups on the fiber surface so as to substantially inhibit bonding between hydroxyl groups of different fibers, thereby substantially reducing inter-fiber hydrogen bonding so that the chemically treated fibers can be more readily dispersed in the building material.
2. The building material of Claim 1, wherein the dispersant binds hydroxyl groups on the fiber surface so as to substantially inhibit bonding between hydroxyl groups of the same fiber, thereby substantially reducing intra-fiber hydrogen bonding.
3. The building material of Claim 1, wherein the dispersant physically blocks the hydroxyl groups from bonding with hydroxyl groups of different fibers.
4. The building material of Claim 1, wherein the dispersant comprises at least one functional group that chemically bonds to the hydroxyl groups on the fiber surface in a manner so as to substantially prevent the hydroxyl groups from bonding with hydroxyl groups of different fibers.
5. The building material of Claim 1, wherein the dispersant comprises a surfactant that imparts the fibers improved dispersibility in an aqueous environment.
6. The building material of Claim 1, wherein the dispersant comprises organic compounds selected from the group consisting of polyamine compounds, cationic quaternaryamine surfactants, cationic surfactants, anionic surfactants, non-ionic surfactants, alkylalkoxysilane, alkoxysilane, halide organosilane, and mixtures thereof.
7. The building material of Claim 1, wherein the dispersant comprises approximately 0.001%-20% of the oven dry weight of the fibers.
8. The building material of Claim 1, wherein the dispersant comprises a debonder.
9. The building material of Claim 1, wherein the building material comprises a cementitious matrix, wherein the chemically treated fibers with improved dispersibility are incorporated in the cementitious matrix.

10. The building material of Claim 9, wherein the chemically treated fibers comprise about 0.5% - 20% by weight of the building material.

11. The building material of Claim 10, wherein the chemically treated fibers with improved dispersibility comprise about 4% - 12% by weight of the building material.

12. The building material of Claim 9, wherein the chemically treated fibers with improved dispersibility increase the strain of the building material by more than about 5% as compared to a building material made from an equivalent formulation without chemically treated fibers with improved dispersibility.

13. The building material of Claim 9, wherein the chemically treated fibers with improved dispersibility increase the modulus of rupture of the building material by more than about 5% as compared to a building material made from an equivalent formulation without chemically treated fibers with improved dispersibility.

14. The building material of Claim 9, wherein the chemically treated fibers with improved dispersibility increase the Z-direction tensile strength of the building material by more than about 10% as compared to a building material made from an equivalent formulation without chemically treated fibers with improved dispersibility.

15. The building material of Claim 9, wherein the chemically treated fibers with improved dispersibility increase the toughness of the building material by approximately 20% as compared to a building material made from an equivalent formulation without chemically treated fibers with improved dispersibility.

16. The building material of Claim 9, wherein the chemically treated fibers with improved dispersibility reduce the fiber dosage by about 5% as compared to a building material made from an equivalent formulation without chemically treated fiber with improved dispersibility.

17. The building material of Claim 9, wherein the chemically treated fibers with improved dispersibility comprise fibers having a length-weighted average length of longer than about 1 mm.

18. A method of manufacturing a building material, comprising:  
providing cellulose fibers;

treating at least a portion of the cellulose fibers with a dispersant to form chemically treated fibers with improved dispersibility, wherein the dispersant imparts improved fiber dispersibility in the aqueous phase;

mixing the chemically treated fibers with a cementitious binder and other ingredients to form a fiber cement mixture;

forming the fiber cement mixture into a fiber cement article of a pre-selected shape and size; and

curing the fiber cement article so as to form a fiber reinforced composite building material.

19. The method of Claim 18, wherein treating the fibers comprises treating the cellulose fibers in a solution containing surfactants.

20. The method of Claim 18, wherein treating the fibers in solution comprises applying between about 0.001%-20% of dispersants to the fibers by fiber mass.

21. The method of Claim 18, wherein treating the fibers comprises chemically bonding a dispersant to the fiber surface in a manner such that the dispersant substantially blocks at least a portion of the hydroxyl groups on the fiber surface.

22. The method of Claim 18, wherein treating the fibers comprises using a dry spray process to deposit dispersants on the fiber surface.

23. The method of Claim 18, wherein providing the fibers comprises fiberizing the fibers, wherein the fiberization process can be carried out before, during or after the step of treating the fibers.

24. The method of Claim 18, wherein providing the fibers comprises fibrillating the fibers to a range of between about 100 to 700 degrees of Canadian Standard Freeness.

25. The method of Claim 18, wherein providing the fibers comprises chemically removing the lignins of the fibers so as to individualize the fibers.

26. The method of Claim 18, wherein forming the fiber cement mixture into a fiber cement article comprises using a process selected from the group consisting of extrusion, injection molding, molding, Hatschek, and others.

27. A method of manufacturing a building material, comprising:

mixing fibers that have been chemically treated with a dispersant with a cementitious binder and other ingredients to form a fiber cement mixture;

forming the fiber cement mixture into a fiber cement article of a pre-selected shape and size; and

curing the fiber cement article so as to form a fiber reinforced composite building material.

28. The method of Claim 27, wherein mixing fibers that have been chemically treated with a dispersant comprises mixing the treated fluff pulps with a cementitious binder and other ingredients to form a fiber cement mixture.

29. A building material formulation used to form a building material, comprising:  
a hydraulic binder;  
an aggregate;  
cellulose fibers, wherein at least a portion of the fibers are at least partially treated with a dispersant to form chemically treated fibers with improved dispersibility, wherein the dispersant binds hydroxyl groups on the fiber surface so as to substantially inhibit bonding between hydroxyl groups of different fibers, thereby substantially reducing inter-fiber hydrogen bonding so that the chemically treated fibers can be more readily dispersed in a mixture.

30. The formulation of Claim 29, wherein the cellulose fibers comprise about 0.5%-20% of the formulation by weight.

31. The formulation of Claim 29, wherein about up to 100% of the cellulose fibers by weight are at least partially treated with a dispersant.

32. The formulation of Claim 29, wherein the dispersant treated cellulose fibers comprise fluff pulps treated with debonders.

33. The formulation of Claim 29, wherein at least a portion of the fibers are at least partially treated with a dispersant selected from the group consisting of polyamine compounds, cationic quaternaryamine surfactants, alkylalkoxysilane, alkoxysilane, and halide organosilane, and combinations thereof.

34. The formulation of claim 29, wherein the hydraulic binder comprises about 20%-50% cement by weight.

35. The formulation of Claim 29, wherein the aggregate comprises about 20%-80% silica by weight.

36. The formulation of Claim 30 further comprising 0% - 50% additives.

37. The formulation of Claim 36, wherein the additives comprises low density additives.

38. The formulation of Claim 29, wherein the cellulose fibers comprise individualized cellulose fibers.

35. The formulation of Claim 29, wherein the aggregate comprises about 20%-80% silica by weight.